CLIMATE CHANGE

Climate change is one of the greatest environmental, social and economic threats facing the planet. The warming of the climate system is definite, as now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global mean sea level. The Earth's average surface temperature has risen by 0.76° C since 1850. Most of the warming that has occurred over the last 50 years is very likely to have been caused by human activities. Human activities that contribute to climate change include in particular the burning of fossil fuels, agriculture and land-use changes like deforestation. These cause emissions of carbon dioxide (CO_2), the main gas responsible for climate change, as well as of other 'greenhouse' gases. To bring climate change to a halt, global greenhouse gas emissions must be reduced significantly. Climate Change in Malta Malta is in the warm Mediterranean sun for most of the year, but according to scientist, southern Europe and small islands such as Malta stand at particular risk of climate change.

Small islands such as Malta, whether in the tropics or higher latitudes, have certain characteristics that place them in an especially vulnerable position when it comes to dealing with the rising sea levels and extreme weather events expected to result from climate change. Small islands also face a deterioration of coastal conditions through the erosion of beaches that will, in turn, reduce the tourism value of such locations and affect local resources such as fishing.

Climate change is also expected to magnify regional differences in Europe's natural resources and assets. Negative impacts will include an increased risk of inland flash floods, more frequent coastal flooding and increased erosion due to storminess and rising sea levels. The great majority of organisms and ecosystems, meanwhile, will have difficulty adapting to such climate change.

7.2.1 CLIMATE CHANGE IMPACTS ON URBAN AREAS

Climate change has different kinds of impacts on urban areas, some of which are as follows:

- **Flooding:** Due to climate change urban areas always present some risk of flooding when rainfall occurs. Buildings, roads, infrastructure and other paved areas prevent rainfall from infiltrating into the soil and so produce more runoff. Heavy and/or prolonged rainfall produces very large volumes of surface water in any city, which can easily overwhelm drainage systems. Climate change has the potential to increase flooding risks in cities in three ways: from the sea (higher sea levels and storm surges); from rainfall – for instance by heavier rainfall or rainfall that is more prolonged than in the past; and from changes that increase river flows – for instance through increased glacial melt.

- **Storms, sea-level rise and coastal urban populations:** It is difficult to estimate precisely how many people are at risk from the increased frequency and intensity of extreme-weather events and the sea-level rise that climate change will bring.

Weather anomalies such as hurricanes may occur more frequently, causing immense damage to nature, humans and property.

- **Constraints on water supplies:** In Asia, "Freshwater availability in Central, South, East and Southeast Asia, particularly in large river basins, is projected to decrease due to climate change which, along with population growth and increasing demands arising from higher standards of living, could adversely affect more than a billion people by the 2050s." Any reduction in the availability of freshwater resources caused by climate change will be particularly problematic for those who live in areas already suffering water scarcity or water stress – with poorer groups likely to be most affected.

- **Higher temperatures and heat waves:** Most cities in Africa, Asia and Latin America and the Caribbean will experience more heat waves. Even small increases in average temperature can result in large shifts in the frequency of extremes. For larger, higher-density cities, the temperatures in central "heat islands" can be several degrees higher than in surrounding areas; in tropical cities, the temperature difference can reach 10 degrees by the end of the night. Many cities will face more problems with certain air pollutants as concentrations of air pollutants change in response to climate change because a portion of their formation depends, in part, on temperature and humidity. In regard to urban heat islands, higher temperatures occur in urban areas than in outlying rural areas because of diurnal cycles of absorption and later re-radiation of solar energy and (to a much lesser extent) heat generation from built/paved physical structures. These increase the frequency and severity of heat-stress events in cities and can affect the health, labour productivity and leisure activities of the urban population. There are also economic effects, such as the additional cost of climate-control within buildings, and environmental effects, such as the formation of smog in cities and the degradation of green spaces – and increased greenhouse gases if additional demand for cooling is met with electricity generated from fossil fuels.

- **Other health risks related to climate change:** Climate change is also likely to bring an increased burden of diarrhoeal disease and altered spatial distribution of some infectious disease vectors – for instance as warmer average temperatures permit an expansion of the area in which many "tropical" diseases can occur. Expansion is likely in the area in which the mosquitoes that spread malaria, dengue fever and filariasis can survive and breed. Populations with poor sanitation infrastructure and high burdens of infectious disease often experience increased rates of diarrhoeal diseases, cholera and typhoid fever after flood events. The transmission of enteric pathogens is generally higher during the rainy season.

7.3 GREENHOUSE EFFECT (GLOBAL WARMING)

The term greenhouse was given by **J. Fourier** in 1827. The energy of the sun is emitted as heat radiations. Sun rays consist of ultraviolet (UV) rays, visible light and infrared radiations. Ozone layer present in stratospheric region of the atmosphere absorbs UV rays and allows visible and infrared radiations to pass through it towards earth. Some of the radiations (*near infrared rays*) penetrate the earth's surface by easily passing through the carbon dioxide layer present in the atmosphere and some of the heat radiations (*longer wavelength heat rays*) are absorbed and retained by the earth's surface. Some of this absorbed heat is then re-radiated by the heated earth. The temperature of the earth's surface is determined by the energy balance between the heat energy reaching the earth's surface and the heat energy that is radiated back into space.

In the last few years fossil fuel-based industrialization and man's degenerative life-style based on over-exploitation of resources like coal, oil and gases which take generations to regenerate has resulted in an unprecedented rise in the concentration of green house gases. ***The major natural greenhouse gases are water vapor, which causes about 36-70% of the greenhouse effect on Earth (not including clouds); carbon dioxide CO_2, which causes 20-56%; methane, which causes 4-18%, and ozone, which causes 3-7%.*** It is not possible to state that a certain gas causes a certain percentage of the greenhouse effect, because the influences of the various gases are not additive. ***Other greenhouse gases include, but are not limited to, nitrous oxide, sulfur hexafluoride, hydrofluorocarbons, perfluorocarbons and chlorofluorocarbons***. These greenhouse gases in the lower levels of the atmosphere act like the glass of green house. *Like glass they are transparent to the near infrared rays (of short wavelength heat rays) but are opaque to the heat radiated by the heated earth (longer wavelength heat rays) and trap them.* By not letting the solar rays to escape into outer space, greenhouse gases add to the heat that is already present on the Earth's surface. This results in an increase in temperature and is commonly known as the '*green house effect'*. On the global level this effect is known as '*global warming*'. *Global warming is the increase in the average temperature of Earth's near-surface air and oceans* since the mid-20th century and its projected continuation. According to the 2007 Fourth Assessment Report by the Intergovernmental Panel on Climate Change (IPCC), global surface temperature increased 0.74 ± 0.18 °C (1.33 ± 0.32 °F) during the 20th century. Most of the observed temperature increase since the middle of the 20th century was caused by increasing concentrations of greenhouse gases, which results from human activity such as fossil fuel burning and deforestation

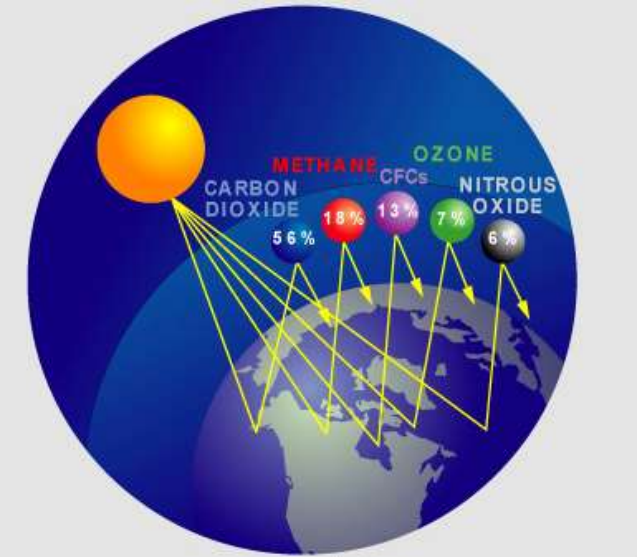

Figure 7.1: Contribution of greenhouse gases in global warming

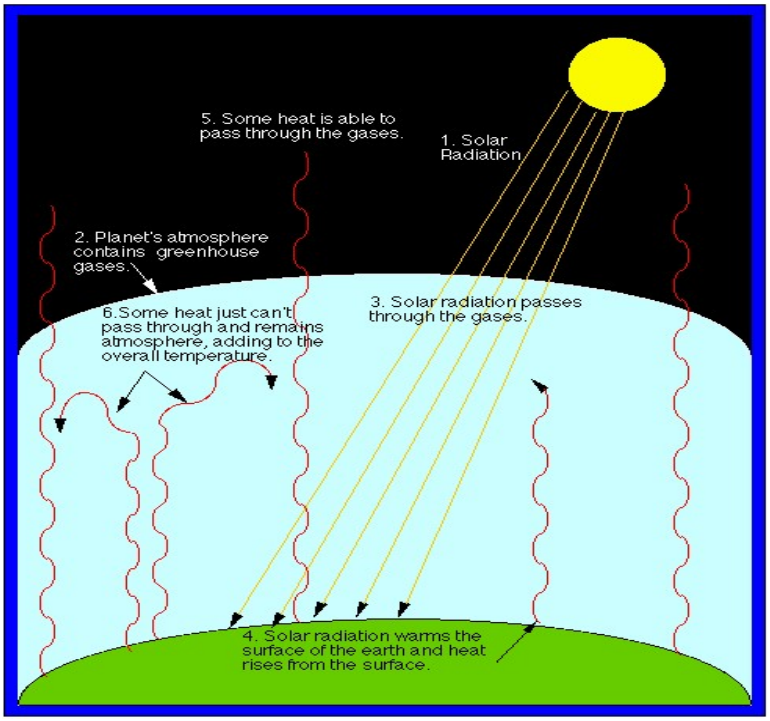

Figure 7.2: Representation of process of global warming

The higher the concentration of green house gases like carbon dioxide in the atmosphere, the more heat energy is being reflected back to the Earth. The emission of carbon dioxide into the environment mainly from burning of fossil fuels (oil, gas, petrol, kerosene, etc.) has been increased dramatically over the past 50 years.

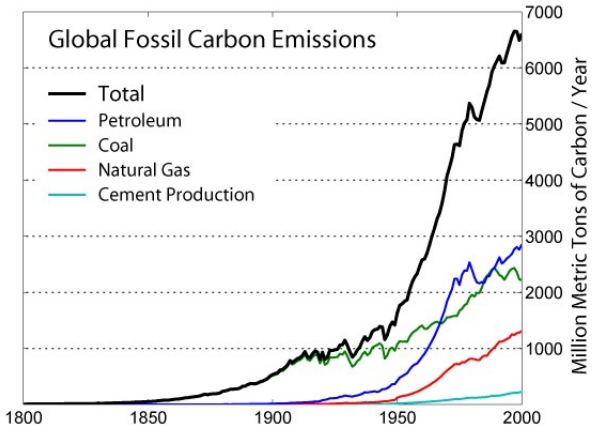

Figure 7.3: Cause for global warming: Carbon dioxide emissions in million tons per year over the last 200 years

7.3.1 EFFECTS OF GLOBAL WARMING

The planet is warming, from North Pole to South Pole, and everywhere in between. Globally, the mercury is already up more than 1 degree Fahrenheit (0.8 degree Celsius), and even more in sensitive Polar Regions. And the effects of rising temperatures aren't waiting for some far-flung future. They're happening right now. Signs are appearing all over, and some of them are surprising. The heat is not only melting glaciers and sea ice, it's also shifting precipitation patterns and setting animals on the move.The green house effect poses the following serious environmental threats. Some impacts from increasing temperatures are already happening.

- Ice is melting worldwide, especially at the Earth's poles. This includes mountain glaciers, ice sheets covering West Antarctica and Greenland, and Arctic sea ice.
- Sea levels are expected to rise between 7 and 23 inches (18 and 59 centimeters) by the end of the century, and continued melting at the poles could add between 4 and 8 inches (10 to 20 centimeters).
- Some butterflies, foxes, and alpine plants have moved farther north or to higher, cooler areas.
- Precipitation (rain and snowfall) has increased across the globe, on average.
- Hurricanes and other storms are likely to become stronger.
- Floods and droughts will become more common.
- Flooding of the coastal areas will cause massive soil erosion and siltation, Less fresh water will be available. If the Quelccaya ice cap in Peru continues to melt at its current rate, it will be gone by 2100, leaving thousands of people who rely on it for drinking water and electricity without a source of either.
- Water will be contaminated and water bore and water induced diseases will spread, such as malaria carried by mosquitoes.

- In temperate regions, the summers will be longer and hotter whereas the winters will be shorter and warmer.
- Ecosystems will change—some species will move farther north or become more successful; others won't be able to move and could become extinct.